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Kombinasi Latihan Range of Motion dan Kompres Hangat Terhadap Kekuatan Otot Pasien Stroke Non-Hemoragik : Sebuah Studi Kasus

Combined Range of Motion Exercises and Warm Water Compress Therapy on Muscle Strength in Non-Hemorrhagic Stroke Patients : A Case Study

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ABSTRACT

Background: Non-hemorrhagic stroke causes muscle weakness and limitations in daily activities, which may progress to permanent disability if not managed optimally. A combination of Range of Motion (ROM) exercises and warm water compress therapy is a nursing intervention with potential to improve muscle strength in stroke patients. **Objective:** To describe the application of combined ROM exercises and warm water compress therapy on muscle strength in patients with non-hemorrhagic stroke. **Method:** A descriptive case study was conducted on one patient with non-hemorrhagic stroke at RSUD Kota Kendari. The intervention consisted of warm water compress therapy at 40–45°C for 5–10 minutes followed by ROM exercises for 20–30 minutes, administered twice daily for six days. **Results:** After six days of intervention, muscle strength in the left upper extremity improved from scale 2 to scale 3 on the fifth and sixth days. The left lower extremity remained at scale 3, although with improved movement control. **Conclusion:** The combination of ROM exercises and warm water compress therapy has the potential to improve upper extremity muscle strength in patients with non-hemorrhagic stroke. **Suggestion:** Further research with more samples is needed.

ABSTRAK

Latar belakang: Stroke non-hemoragik menyebabkan kelemahan otot dan keterbatasan aktivitas sehari-hari, yang dapat berkembang menjadi disabilitas permanen jika tidak dikelola secara optimal. Kombinasi latihan Range of Motion (ROM) dan terapi kompresi air hangat adalah intervensi keperawatan yang berpotensi meningkatkan kekuatan otot pada pasien stroke. **Tujuan:** Untuk menjelaskan penerapan latihan gabungan ROM dan terapi kompresi air hangat pada kekuatan otot pada pasien dengan stroke non-hemoragik. **Metode:** Studi kasus deskriptif dilakukan pada satu pasien dengan stroke non-hemoragik di RSUD Kota Kendari. Intervensi ini terdiri dari terapi kompres air hangat pada suhu 40–45°C selama 5–10 menit diikuti dengan latihan ROM selama 20–30 menit, yang diberikan dua kali sehari selama enam hari. **Hasil:** Setelah enam hari intervensi, kekuatan otot di ekstremitas atas kiri meningkat dari skala 2 menjadi skala 3 pada hari kelima dan keenam. Ekstremitas bawah kiri tetap pada skala 3, meskipun dengan kontrol gerakan yang lebih baik. **Kesimpulan:** Kombinasi latihan ROM dan terapi kompres air hangat berpotensi meningkatkan kekuatan otot ekstremitas atas pada pasien stroke non-hemoragik. **Saran:** Penelitian lebih lanjut dengan lebih banyak sampel diperluka.

INTRODUCTION

Stroke is one of the leading causes of death and disability worldwide. According to reports by the World Health Organization (WHO) and World Stroke Organization (WSO), there were 11.9 million new stroke cases and approximately 93.8 million people living with a history of stroke in 2021. Over the past two decades (1990–2021), stroke incidence increased by 70%, mortality by 44%, and Disability-Adjusted Life Years (DALYs) by 32%, with the greatest burden borne by low- and middle-income countries.[1, 2]

In Indonesia, based on the Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) of 2023, the national stroke prevalence reached 8.3 per 1,000 population in the age group above 15 years, contributing 11.2% to total disability and 18.5% to total national mortality. In Southeast Sulawesi Province, stroke prevalence was recorded at 6.6 per 1,000 population, which remains epidemiologically and clinically significant.[3] Data from RSUD Kota Kendari recorded 438 inpatient cases and 395 outpatient cases of non-hemorrhagic stroke over the last three years (2023–2025).[4]

Non-hemorrhagic stroke, or ischemic stroke, occurs due to obstruction of cerebral blood flow, causing ischemia of brain tissue.[5] Clinically, this condition commonly presents with hemiparesis or hemiplegia, decreased muscle strength, impaired balance, and limitations in activities of daily living. Muscle weakness that is not optimally managed contributes to complications such as contracture, reduced independence, and the risk of permanent disability.[6]

Various literature recommends early rehabilitation through mobilization and Range of Motion (ROM) exercises to maintain joint flexibility, prevent contracture, and reduce muscle atrophy. Previous studies have demonstrated that both passive and active ROM exercises in stroke patients can improve muscle strength and activities of daily living. Superficial heat therapy modalities, such as warm water compresses, have been shown to help reduce spasms, muscle stiffness, and improve range of motion through vasodilation mechanisms and increased tissue metabolism.[6]

Several studies have reported that the combination of ROM exercises and warm compresses may produce synergistic effects on improving muscle strength and range of motion in both elderly and post-stroke patients. However, the application of this combination in patients with non-hemorrhagic stroke at RSUD Kota Kendari, particularly in the outpatient neurology clinic, remains limited and has not been systematically documented as part of rehabilitative nursing care.

The identified research gap is the suboptimal utilization of the combination of ROM exercises and warm water compress therapy as a structured nursing intervention, particularly in the outpatient neurology clinic at RSUD Kota Kendari. This study aims to describe the application of both interventions on muscle strength in non-hemorrhagic stroke patients as preliminary evidence to support the development of standardized rehabilitative nursing intervention protocols in healthcare settings.

Departing from the high disability rate due to non-hemorrhagic stroke, muscle weakness and activity limitations are major problems frequently encountered in patients in neurology services, including at the Neurology Clinic of RSUD Kota Kendari. Post-stroke muscle weakness directly affects independence in daily activities, thereby requiring rehabilitative interventions focused on optimizing muscle strength and joint range of motion. Various studies indicate that Range of Motion (ROM) exercises, both passive and active, can maintain and improve joint range of motion, prevent contractures, and stimulate neuromuscular activation, while warm water compresses provide local vasodilation, increase blood flow, reduce muscle spasm, and decrease stiffness so that patients feel more comfortable prior to exercise.

Previous research has reported that ROM exercises alone can improve muscle strength and motor function, while warm compresses contribute to reducing spasm and increasing range of motion, and that the combination of both in older adults and stroke patients yields significant improvements in muscle strength and daily living activities. In this study, the combination of ROM exercises and warm water compresses is applied to non-hemorrhagic stroke patients at the Neurology Clinic of RSUD Kota Kendari, with muscle strength measured using a 0–5 muscle strength scale before and after the intervention to assess the synergistic effects on muscle strength improvement and to provide applicable scientific evidence for the development of structured, evidence-based rehabilitative nursing interventions in outpatient services of regional hospitals.

METHODS

Research Design

This study employed a descriptive case study design with a nursing process approach encompassing assessment, nursing diagnosis, intervention, implementation, and evaluation to describe the application of combined Range of Motion (ROM) exercises and warm water compress therapy on muscle strength in a patient with non-hemorrhagic stroke.

Research Location and Time

The study was conducted in Neurology Outpatient Clinic, Kendari City Public Hospital, for six consecutive days, with one therapy session per day lasting 30–60 minutes in the morning, province in 11-16 April, 2026.

Population and Sample

The population consisted one research subject, a 52-year-old male patient (Mr. M) diagnosed with non-hemorrhagic stroke. The subject was selected purposively based on the following inclusion criteria: diagnosed with non-hemorrhagic stroke, experiencing left extremity muscle weakness with an MRC scale of 2–3, clinically stable general condition, able to communicate verbally, and willing to participate by signing written informed consent. Exclusion criteria included the presence of open wounds or other contraindications in the extremities to be treatedl.

Research Instruments and Data Collection

Data collection consisted of primary and secondary data. Primary data were obtained through structured interviews with the patient and family, direct observation, and physical examination focusing on muscle strength and joint range of motion. Secondary data were collected from medical records and clinical documentation at RSUD Kota Kendari. The research instruments used included a standardized medical-surgical nursing assessment form and a muscle strength observation sheet utilizing the Medical Research Council (MRC) Muscle Strength Scale (0–5), an internationally standardized, valid, and reliable instrument for assessing muscle strength in stroke patients. Assessments were performed before the intervention (pre-test) and daily throughout the six-day intervention period (daily post-test).

Data Analysis

Data were analyzed descriptively using three approaches: (1) narrative comparison of MRC muscle strength scores before and after the intervention; (2) tabulation of daily observation data to illustrate the trajectory of muscle strength changes over the six-day intervention; and (3) qualitative clinical description covering activities of daily living, comfort levels, and patient responses to the intervention. Ethical considerations included obtaining written informed consent, maintaining subject anonymity, ensuring data confidentiality, and upholding the principle of beneficence so that the therapeutic benefits outweighed any potential risks.

RESULTS

Subject Identification

The research subject was a male patient with the initials Mr. M, aged 52 years, Muslim, with elementary school education, and working as a self-employed individual. The patient resided in Southeast Sulawesi Province and was first diagnosed with non-hemorrhagic stroke in January 2026. The patient attended a follow-up visit at the Neurology Outpatient Clinic of RSUD Kota Kendari on April 7, 2026, presenting with the chief complaint of left extremity weakness.

Table 1. Initial Assessment Results

Parameter	Findings
Level of Consciousness	Compos mentis (GCS 15)
Blood Pressure	Within controlled limits
Chief Complaint	Left extremity weakness since stroke onset in January 2026

Left Upper Extremity Muscle Strength	Grade 2 (movement only horizontal; unable to move against gravity)
Left Lower Extremity Muscle Strength	Grade 3 (movement against gravity only; unable to resist applied force)
Joint Condition	Stiffness in the left wrist and ankle joints
Functional Ability	Limited ability to grasp objects, lift the arm, and walk independently
Nursing Diagnosis	Impaired physical mobility related to decreased muscle strength (SDKI D.0054)

Table 1 shows that the subject experienced left-sided extremity weakness, with upper extremity muscle strength at grade 2 (capable of horizontal movement but unable to overcome gravity) and lower extremity strength at grade 3 (capable of overcoming gravity but unable to overcome resistance). This condition was accompanied by left wrist involvement, as well as functional limitations in grasping objects, lifting the arm, and walking independently. Based on these findings, a diagnosis of impaired physical mobility related to decreased muscle strength (SDKI D.0054) was established, serving as the basis for an intervention combining Range of Motion (ROM) exercises and warm air compression.

Table 2. Changes in Left Extremity Muscle Strength Before and After Combined ROM and Warm Water Compress Intervention

Day / Date	Type of Exercise	Left Upper Extremity (Pre → Post)	Left Lower Extremity (Pre → Post)	Remarks
Baseline/ April 10, 2026	before intervention	2	3	Initial condition before program commencement
Day 1 / April 11, 2026	Passive ROM + warm compress	2 → 2	3 → 3	No change; initial adaptation phase
Day 2 / April 12, 2026	Passive ROM + warm compress	2 → 2	3 → 3	No change; patient becoming more cooperative
Day 3 / April 13, 2026	Passive ROM + warm compress	2 → 2	3 → 3	Subjective reduction in joint stiffness
Day 4 / April 14, 2026	Passive ROM + warm compress	2 → 2	3 → 3	Improved movement control; stabilization phase
Day 5 / April 15, 2026	Active-assisted ROM + warm compress	2 → 3	3 → 3	Significant improvement in upper extremity: able to move against gravity
Day 6 / April 16 2026	ROM aktif-terbantu + kompres hangat	3 → **3**	3 → 3	Superior Grade 3 Stability

Table 2 illustrates the pattern of gradual changes in muscle strength over the six-day intervention period. From day one to day four, muscle strength in the upper and lower extremities remained relatively stable (at grade 2 and grade 3, respectively), although clinical records indicated subjective improvements specifically reduced joint stiffness and enhanced movement control starting on the third day. A significant increase was observed only on the fifth day, when upper extremity muscle strength rose from grade 2 to grade 3, a level that remained stable on the sixth day.

Conversely, lower extremity muscle strength showed no increase in grade throughout the intervention period, remaining at grade 3, despite clinical improvements in the quality of movement control. This pattern indicates that the neuromuscular response to the combination of ROM exercises and warm compresses is progressive and becomes significant only after more than four days of consistent intervention, with effects manifesting more rapidly in the upper extremities than in the lower extremities.

Table 3. Functional Changes Before and After Intervention

Functional Aspect	Condition Before Intervention	Condition After Intervention (Day 6)
Grasping objects	Unable to hold a glass	Able to hold a glass with minimal assistance
Lifting the arm	Only able to slide the arm horizontally	Able to lift the arm against gravity
Position changes	Required full assistance	Able to turn with partial assistance
Sit-to-stand exercise	Required full assistance	Able with minimal assistance and supervision

Independent exercise participation	Passive; only received ROM from the nurse	Active participation; began performing movements independently
Muscle comfort	Stiffness and heaviness in the left extremity	Reduced stiffness; comfort improved after warm compress

Table 3 shows improvements in functional ability across all observed aspects following six days of intervention. Prior to the intervention, the subject required full assistance to change positions and to transition between sitting and standing, and could only slide their arm horizontally without the ability to grasp objects. Following the intervention, the subject was able to lift their arm against gravity, hold a glass with minimal assistance, change positions and transition between sitting and standing with supervision, and actively participate in exercises that were previously passive. Improvements were also observed regarding muscle comfort, evidenced by reduced stiffness after the application of warm compresses. Overall, these changes confirm that increased upper-extremity muscle strength directly contributes to improved functional independence in activities of daily living, even though improvements in the lower extremities were more limited to aspects of movement control rather than quantitative strength gains.

DISCUSSION

The findings of this case study indicate that the combination of Range of Motion (ROM) exercises and warm water compress therapy has the potential to improve upper left extremity muscle strength in a patient with non-hemorrhagic stroke, as evidenced by an increase in MRC grade from 2 to 3 after six days of intervention. This finding is specifically consistent with the case study conducted by Putri & Binoriang (2025) involving elderly stroke patients receiving a similar combination of ROM and warm compress therapy, in which the mean extremity muscle strength increased from 2.45 to 3.35.[7] Museva (2024) also reported consistent results, demonstrating that routinely administered passive ROM exercises significantly improved muscle strength in non-hemorrhagic stroke patients, even without warm compress therapy.[8]

Furthermore, Febriana & Akbar (2024) in a study of 24 stroke patients who received bilateral ROM exercises for the upper extremities over five days reported an increase in mean muscle strength from 3.38 to 4.50, indicating that adequate frequency and duration play a major role in intervention outcomes.[9] Agusrianto & Rantesigi (2020) in a quasi-experimental study involving 15 stroke patients confirmed that passive ROM administered consistently twice daily for seven days significantly improved extremity muscle strength.[10]

Physiologically, ROM exercises work through stimulation of proprioceptive receptors muscle spindles, Golgi tendon organs, and joint receptors which maintain soft tissue elasticity, prevent contracture, and stimulate neuromuscular activation through the monosynaptic reflex pathways of the spinal cord.[11] Repeated movement of weakened joints and muscles helps maintain muscle length, increase local blood flow, and reduce the risk of atrophy.[12] Repeated sensorimotor stimulation also induces cortical neuroplasticity, reinforced by increased Brain-Derived Neurotrophic Factor (BDNF), supporting reorganization of the motor cortex following stroke.[13]

Warm water compress therapy contributes through vasodilation mechanisms that increase tissue perfusion, reduce muscle stiffness, and provide comfort and relaxation.[14] The elevation of local tissue temperature triggers a reduction in blood viscosity, increased oxidative metabolism, and improved collagen tissue elasticity, thereby facilitating the execution of ROM exercises.[15] The combination of both interventions produces a synergistic effect: warm compress optimally prepares the metabolic and neuromuscular conditions of the muscles, while ROM exercises activate contractile and sensorimotor coordination that is essential for motor function recovery. The combination of both interventions produces a synergistic effect: warm compress optimally prepares the metabolic and neuromuscular conditions of the muscles, while ROM exercises activate contractile and sensorimotor coordination that is essential for motor function recovery.

First, the lower extremity was already at grade 3 at the initial assessment, meaning the muscle was capable of moving against gravity but unable to resist applied force. Progression from grade 3 to grade 4 requires greater contractile force generation and recruitment of more motor units, which

neurophysiologically demands more time and higher stimulation intensity compared to the transition from grade 2 to grade 3.[16] Second, six days of intervention was likely insufficient to induce structural changes in the lower extremity motor units, which anatomically possess a larger muscle mass and require a more progressive exercise load.[12] Third, the absence of resistive or progressive resistance exercises in this program limited the recruitment of type II muscle fibers necessary for strength gains against resistance.[11] Fourth, individual comorbidity factors such as the degree of corticospinal tract damage from stroke, age, and cardiovascular condition all influence motor recovery capacity and could not be controlled within the limitations of this single-subject case study design.

The findings of this study reinforce the strategic role of nurses in designing and implementing simple, measurable, and low-cost rehabilitative interventions. However, practical implications require elaboration in three specific areas, Optimal frequency and duration. Based on this study's findings and the literature, administering the intervention twice daily (morning and afternoon), with a total duration of 25–40 minutes per session for at least six days, appears to produce clinically meaningful changes in upper extremity muscle strength. To achieve improvement in the lower extremity, the program duration should be extended to a minimum of 10–14 days with progressive intensity increments. [10, 12] A standardized, documented intervention schedule within nursing records is recommended to ensure consistent implementation.

Caregiver training. Given that outpatient non-hemorrhagic stroke patients can only be directly monitored during clinic visits, the active involvement of family members as informal caregivers is critical for the continuity of home rehabilitation. Family education should encompass safe warm compress techniques (temperature control, duration, skin monitoring), simple ROM procedures for the weakened extremity, and recognition of danger signs (excessive pain, redness, or deterioration). Nurses must ensure families are able to demonstrate the procedures back (teach-back method) before the patient is discharged.[17]

Barriers to implementation in outpatient settings. Applying this combination intervention in outpatient neurology clinics faces several potential barriers, including: (1) limited visit time (typically 30–60 minutes), which precludes full implementation at the facility; (2) dependence on patient and family adherence for continuing home exercises; (3) absence of written guides (leaflets or educational videos) that patients can take home; and (4) potential risk of injury if ROM is performed without adequate supervision. Therefore, integration of this intervention into community-based home care programs or tele-rehabilitation services should be considered as a medium-term solution.[18]

This case study has inherent limitations, as it involved only one subject without a control group and did not employ inferential statistical analysis; therefore, generalization of findings is highly limited. Confounding factors such as pharmacological therapy received by the patient, initial stroke severity, adherence to home exercises, and comorbid conditions could not be fully controlled. Furthermore, the absence of standardized functional outcome instruments such as the Barthel Index or Fugl-Meyer Assessment limited the quantitative evaluation of functional outcomes. Future research with a quasi-experimental or randomized controlled trial (RCT) design, larger sample sizes, control groups, and standardized functional instruments is strongly warranted to confirm the effectiveness of this combined intervention.

CONCLUSIONS AND SUGGESTIONS

This case study showed that the combination of ROM exercises and warm water compresses had the potential to increase upper extremity muscle strength in non-hemorrhagic stroke patients, marked an increase in MRC from grade 2 to 3 on the fifth and sixth days of the intervention, although the lower extremities did not show grade improvement despite improvements in movement control and coordination. The intervention has also been shown to reduce joint stiffness, improve patient comfort, and improve functional abilities in daily activities, but because the design of this single case study is limited, generalization of results needs to be done carefully. Based on these findings, it is recommended that nurses in outpatient and home services apply warm water compresses (40–45°C, 5–10 minutes) followed by passive/active-assist ROM exercises (20–30 minutes, 8 reps) twice a day

for at least 6–14 days in MRC grade 1–3 patients with stable conditions, accompanied by family education as caregivers.

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